

*PUNISHMENT OF SELF-INJURIOUS BEHAVIOR USING  
AROMATIC AMMONIA AS THE AVERSIVE STIMULUS*

BARRY A. TANNER<sup>1</sup> AND MARLENE ZEILER

GEORGIA REGIONAL HOSPITAL AT ATLANTA

Punishment with aromatic ammonia was used to eliminate self-injurious behavior of an autistic woman during experimental sessions. The effects were reversible but were limited to experimental sessions until staff used the ammonia on the ward at all times.

DESCRIPTORS: aversive control, aromatic ammonia, self-injurious behavior

Punishment rapidly and effectively reduces self-injurious behavior (Lovaas, Schaeffer, and Simmons, 1965; Lovaas and Simmons, 1969; Risley, 1968; Tate, 1972; Tate and Baroff, 1966). In a comparison of three procedures, Corte, Wolfe, and Locke (1971) reported that extinction was ineffective in reducing such behavior, differential reinforcement of a competing response was effective only under conditions of food deprivation, but punishment consistently reduced the frequency of self-injurious behavior. In addition, Smolev (1971) pointed out that while nonaversive procedures may be preferable to aversive control, because they involve less discomfort for the subject, such procedures may allow subjects to injure themselves, a behavior that might be quickly suppressed with punishment. Therefore, when danger to the subject, or staff limitations, preclude the use of extinction or differential reinforcement, punishment is indicated.

To be effective, punishment requires the use of an intense stimulus delivered immediately after the response (Azrin and Holz, 1966). Otherwise, responding will either not be affected, or will be only temporarily reduced. Electric shock is effective when applied appropriately, although it is not without problems. For example, ethical considerations preclude supplying

shock stimulators to all staff whom a patient encounters. Thus, patients may discriminate when shock will or will not be forthcoming. Furthermore, not only may shock be administered indiscriminately, but the stimulator is usually visible enough to establish a discrimination. Justifiable concern over inflicting pain (American Psychological Association, 1971) may sometimes lead to an administrative decision to restrict or even ban the use of shock (Lucero, Voil, and Scherber, 1968).

Other forms of aversive stimuli have been used, for example, loud noise (Azrin, 1958; Flanagan, Goldiamond, and Azrin, 1958), but this is aversive to other patients and staff on the ward, and was only partially effective in reducing responding (Azrin and Holz, 1966). Other stimuli, such as a blast of air (Masserman, 1946) have been used with nonhumans. Aromatic ammonia was therefore tried in the present study because its fumes are very unpleasant, yet produce no lasting effect when used moderately and in diluted form (Goodman and Gilman, 1965); unlike the fumes of household ammonia, aromatic ammonia does not annoy people more than about 2 ft (0.6 m) from the capsule. Immoderate use or an undiluted form would, however, be destructive to the nasal mucosa. The relative safety of ammonia capsules, their cost (2.5 cents per capsule), and their small size make this stimulus a good candidate for distribution to all staff. It was expected that by having all staff conceal capsules on their person, a patient would

<sup>1</sup>Reprints may be obtained from Barry A. Tanner, Northeast Guidance Center, 17000 East Warren, Detroit, Michigan 48224.

have difficulty establishing a discrimination, and the punishment could be continued by staff beyond the end of the study. The present paper reports the use of aromatic ammonia to punish self-injurious behavior of an institutionalized adult.

## METHOD

### *Subject*

The subject was a 20-yr-old autistic woman who slapped herself. Such slapping was sometimes accompanied by vocalizations and screams, but her verbalization was limited to imitating a few words when candy reinforcers were available. A former staff member had reported limited success in shaping verbalizations, but shaping was discontinued when this person resigned. The patient spent most of the day sleeping in a chair in front of the television, occasionally getting up to collect lint from the floor. Unless she was under constant observation, she would eat her own feces and urine. Shock had been successfully used previously to suppress her slapping, but responding had gradually recovered since the shock stimulator had been removed more than a year earlier. When this study began, the subject wore a padded helmet all day and occasionally had her arms restrained to a chair. She would sometimes remove her helmet and slap her face with both hands until staff restrained her again. There was no record of her slapping any other part of her body regularly. Her medication during the first six observation periods was 100 mg of chlorpromazine three times a day, and thereafter was 75 mg of chlorpromazine and 10 mg of trifluoperazine hydrochloride twice a day. Heavier doses of these and other drugs had previously had no effect on her self-injurious behavior, but had increased the amount of time she spent sleeping.

### *Apparatus*

A capsule of aromatic ammonia was concealed in the experimenter's hand. The capsules are odorless until crushed, after which they retain

their power for about 10 min (twice the length of the experimental session used). The fumes are mildly annoying up to about 2 ft (0.6 m) from the source, but are aversive only when the ampule is brought close to the nose. The capsule does not, however, have to come into contact with the nose in order to be highly aversive, and physical contact or prolonged exposure may result in damage to the skin or nasal mucosa. The crushable capsules are manufactured by Burrough's Wellcome Company, with each capsule containing a minimum of "5.41 (0.33 cc) alcohol 36%" according to the package.

### *Recording*

Observation periods lasted from 3 to 5 min, with a maximum of one observation period per working day, since the experimenters felt it unwise initially to leave the subject unhelmeted longer than that. Most observation periods lasted the full 5 min, but one period during the baseline and one during return to baseline were terminated earlier because the subject began to bite herself. No record was kept of the biting because it was observed to be a problem only when the subject was allowed to hit herself at a high rate for more than two consecutive minutes; even under these conditions, biting seldom occurred. Observations were initially made in the day area where the unhelmeted subject occupied her usual chair in front of the television. However, at the request of the head nurse, we moved to an empty meeting room during baseline so that the subject's screaming and slapping would not disturb other patients.

Two independent observers, stationed so that they could neither hear nor see one another's counts, recorded the behavior during every observation session. The junior author generally observed the subject, with the senior author or the nursing supervisor providing a reliability check for the simple event recording. Per cent agreement among the observers was determined by dividing the larger grouped value recorded into the smaller grouped value recorded. Agreement ranged from 93% to 100%, with a mean

of 98%. The rate plotted in Figure 1 was computed from the mean of the two frequencies recorded by the independent observers. A slap was defined as rapidly bringing one or both hands to the subject's face, with the palm in apparent contact with the face. The response was generally easily discriminable because slaps could be both heard and seen; disagreement sometimes occurred between observers when the slaps were emitted more quickly than they could be recorded.

Beginning with the second experimental phase, unit staff also recorded slapping outside of experimental sessions. They recorded the occurrence of each burst or incidence of slapping, rather than noting the number of slaps in each burst. This was done on a 24-hr-per-day basis.

#### *Procedure*

During the first baseline phase, the observers recorded the subject's behavior but otherwise did not respond to her during the 11 observation periods distributed over 21 calendar days. The subject's medication was changed after the sixth observation period in an attempt to suppress her face slapping. The first experimental phase began 10 calendar days (six observation days) after the medication change to allow the drugs time to take effect. During observation periods 12 to 14, a capsule of ammonia was crushed and thrust under the subject's nose when she slapped herself, and was withdrawn when she stopped. During observation periods 15 to 17, the ammonia was used whenever the subject brushed her hair back from her forehead, since it was observed that slapping was always preceded by this movement, although the movement was not always followed by slapping. A single capsule was used for each experimental session, as it maintained strength for more than enough time. The six observation periods of the first experimental phase were distributed over 16 calendar days. During observation periods 18 to 21, there was a return to the baseline conditions in which the experimenters again only recorded the subject's behavior. These four observation periods were distributed over

11 calendar days. Beginning with the twenty-second observation period, the experimental procedure was re-instituted, with one change. During the second experimental phase, all unit staff were instructed in the use of the ammonia and carried capsules with them. While only the senior author administered the ammonia during the experimental sessions, all staff administered it out on the ward, and continued to do so after the experiment was terminated. This was done in the hope that the experimental results would no longer be person or situation specific. The subject's helmet and restraints were not worn during this phase nor were they used during the remainder of the subject's stay at the hospital. The six observation periods were distributed over seven calendar days. A follow-up observation period occurred 21 calendar days after the last experimental session.

#### RESULTS

A record of the subject's face slapping during experimental sessions is presented in Figure 1. During the first six observation periods of baseline, the rate of this behavior ranged from 23 to 45 slaps ( $\bar{X} = 34.3$  per minute). Following the medication change, the rate ranged from 22 to 61 slaps per minute, ( $\bar{X} = 38.4$  per minute). The overall mean for the 11 observation periods of baseline was 36.2 slaps per minute.

During the first experimental phase, the rate of slapping ranged from 0.4 to 3 per minute ( $\bar{X} = 1.3$  per minute) when the experimenter contingently applied ammonia. For the last three observation periods of this phase, the experimenter applied the ammonia following the precursor of the face slapping, and no occurrences of the target behavior were observed. The overall mean for the six observation days of the first experimental phase was 0.7 slaps per minute.

During the return to baseline, the rate of responding recovered to a mean of 42.5 slaps per minute, with a range from 23 to 59 slaps per minute.

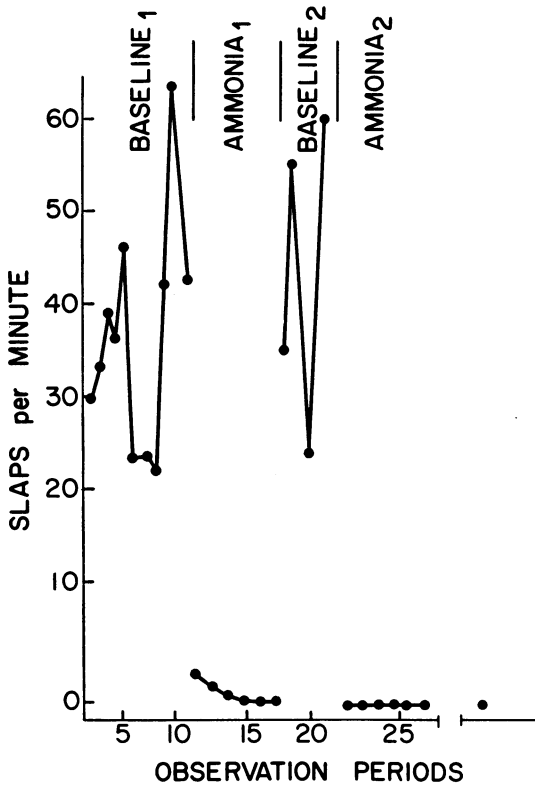


Fig. 1. A record of an autistic woman's face slapping during experimental sessions under baseline and punishment conditions.

Face slapping was immediately eliminated during the second experimental phase. A follow-up observation 21 calendar days after the last experimental session once again found no occurrences of the target behavior.

A record of the subject's face slapping outside of experimental sessions during and after the second experimental phase is shown in Figure 2. During the 23 days of recording, the bursts of slapping ranged from zero to three per day, with a mean of 0.58 per 24 hr. While nursing staff did not record the number of slaps in each burst, they reported anecdotally that the number of slaps was substantially reduced compared to the pre-intervention rate.

## DISCUSSION

This study reports the first published use of ammonia to suppress self-injurious behavior.

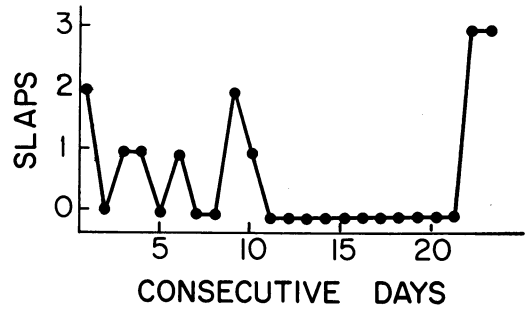


Fig. 2. A record of an autistic woman's face slapping outside of experimental sessions under punishment conditions.

The procedure was quickly effective, and offers an alternative to the more commonly used stimulus, electric shock. Ammonia capsules could easily be carried by all staff in their pockets or pinned to their clothing, thereby involving more people in more places than is often the case. Possibly because capsules were generally concealed, the behavior was reported to have been substantially reduced outside of experimental sessions as well as during them. Unfortunately, no baseline was recorded outside of experimental sessions, as this recording was not introduced on the ward until the second experimental phase. Staff reported no other changes, desirable or undesirable, in the subject's behavior during the study. Because ward staff were able to continue the use of the ammonia, the reduction in slapping appears to have been maintained for the duration of the relatively brief follow-up. No long-term follow-up was possible because the subject was transferred to another institution shortly after the initial follow-up.

Slapping outside of experimental sessions could probably have been reduced further if staff had been more consistent in their use of the ammonia. Several staff were observed to approach the subject when she slapped herself, and then retreat without applying the ammonia if she stopped slapping upon observing their approach. Slapping decreased after the senior author discussed this with staff on the tenth day of staff use, instructing them always to apply the ammonia following a slapping incident. In addition, some staff stopped carrying the ammonia

when no slapping had occurred for several days, and had to scurry for the capsules when the slapping began, e.g., Days 22 and 23. Obviously, discrimination was more of a problem than had been anticipated, and it appeared that punishment would have to be continued indefinitely in order to control the slapping.

The subject reacted violently to the ammonia, turning her head and struggling with the experimenter, although the capsule could be brought to within a few inches of her nose immediately following a slap or antecedent behavior, largely because the subject did not leave her chair. It would undoubtedly be more difficult to use ammonia with a stronger or more agile person. The experimenter and any patient sitting close to the subject were sometimes mildly irritated by the fumes, and the odor lingered on the experimenter's hands after each use. In addition, scabs appeared at the tip of the subject's nose during the second experimental phase, while she had a cold. It is not clear whether the scabs resulted from the cold or because a staff member placed the ammonia capsule in direct contact with the woman's nose. Still, this procedure offers promise, especially in situations where electric shock cannot easily be used.

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